WHAT IS CLAIMED IS:

1. A traveling wave grid assembly comprising:

a planar dielectric substrate;

a plurality of electrically conductive and closely spaced electrodes disposed on said substrate, said electrodes extending parallel to one another and each defining a first end and a second end opposite from said first end;

a layer of a gel material adapted for retention and migration of biomolecules dispersed therein;

a voltage controller adapted to provide an electrical signal having a plurality of phases; and

a plurality of electrically conductive buses providing electrical communication between said controller and said plurality of electrodes, wherein the number of buses corresponds to the number of phases of said electrical signal provided by said controller, and each one of said buses is in electrical communication with both a first end and a second end of a corresponding electrode.

2. The traveling wave grid assembly of claim 1 wherein said plurality of electrodes includes a first electrode, a second electrode adjacent said first electrode, a third electrode adjacent said second electrode, and a fourth electrode adjacent said third electrode, and said plurality of buses includes a first bus in communication with a first end and a second end of said first electrode, a second bus in communication with a first end and a second end of said second electrode, a third bus in communication with a first end and a second end of said third electrode, and a fourth bus in communication with a first end and a second end of said fourth electrode.

3. The traveling wave grid assembly of claim 1 wherein said electrodes comprise copper.

4. The traveling wave grid assembly of claim 1 wherein said electrodes comprise platinum.

5. The traveling wave grid assembly of claim 1 further including a layer of an electrical insulator disposed between said plurality of electrodes and said

plurality of buses, wherein said plurality of buses are oriented in said assembly such that they extend across at least a majority of said electrodes.

6. The traveling wave grid assembly of claim 5 wherein said electrical communication between said buses and said electrodes is provided by electrically conductive vias extending through said layer of electrical insulator.

7. The traveling wave grid assembly of claim 6 wherein said vias comprise copper.

8. The traveling wave grid assembly of claim 1 further comprising:

an electrically conductive plane disposed proximate to said plurality of electrodes and oriented such that said plane is generally parallel to said plurality of electrodes and said layer of gel is disposed between said plurality of electrodes and said plane.

9. The traveling wave grid assembly of claim 1 wherein said plurality of buses comprise copper.

10. The traveling wave grid assembly of claim 1 wherein said plurality of buses comprise aluminum.

11. A traveling wave grid module adapted for use in a vertically integrated tiled system including at least another traveling wave grid module, said module comprising;

a planar dielectric substrate;

a plurality of electrically conductive and closely spaced electrodes disposed on said substrate, said electrodes extending parallel to one another and each defining a first end and a second end opposite from said first end;

a set of electrically conductive contact pads accessible along said substrate; and

a plurality of electrically conductive buses providing electrical communication between said plurality of contact pads and said plurality of electrodes, each one of said buses being in electrical communication with a respective electrode.

12. The traveling wave grid module of claim 11 wherein said dielectric substrate includes:

a glass substrate;

a layer of an electrical insulator.

13. The traveling wave grid module of claim 12 wherein said layer of said electrical insulator is disposed between said plurality of electrodes and said plurality of buses.

14. The traveling wave grid module of claim 12 wherein said plurality of buses is dispose between said layer of said electrical insulator and said glass substrate.

15. An electrophoretic cell having a plurality of traveling wave modules, said cell comprising:

a first planar substrate and a second planar substrate spaced from and parallel with said first substrate; and

a plurality of traveling wave modules disposed between said first substrate and said second substrate, each said traveling wave module including (i) a module base, (ii) a plurality of closely spaced electrodes extending across said base, (iii) a plurality of electrically conductive buses in electrical communication with said electrodes, (iv) a plurality of contact pads at which electrical communication to said buses is provided, and (v) a layer of a suitable gel adapted for electrophoresis techniques disposed adjacent said electrodes;

wherein said plurality of traveling wave modules are arranged between said first and second substrates so as to provide at least one column including at least two traveling wave modules, said at least two modules in said column in electrical communication with each other by electrical contact between respective contact pads of said modules in said column.

16. The electrophoretic cell of claim 15 wherein said cell includes 2 to 20 columns of traveling wave modules.

17. The electrophoretic cell of claim 16 wherein each of said columns includes 2 to 10 traveling wave modules.

18. A system for separating, transporting or focusing biomolecules, said system comprising:

a substrate;

a plurality of closely spaced, parallel, electrically conductive electrodes disposed on said substrate;

a layer of a material adapted for the retention and migration of biomolecules disposed therein; and

a voltage controller in electrical communication with said plurality of electrodes, said voltage controller providing a four phase electrical control signal to said plurality of electrodes;

wherein depending upon the signal provided by said voltage controller, a particular mode of transport is imparted to biomolecules disposed in said layer.

19. The system of claim 18 wherein a uni-directional mode of transport is imparted to said biomolecules by said control signal providing: (i) a first voltage pulse in a first phase of said signal within a first quarter period of a control cycle, (ii) a second voltage pulse in a second phase of said signal within a second quarter period of said control cycle, (iii) a third voltage pulse in a third phase of said signal within a third quarter period of said control cycle, and (iv) a fourth voltage pulse in a fourth phase of said signal within a fourth quarter period of said control cycle.

20. The system of claim 18 wherein a bi-directional mode of transport is imparted to said biomolecules by said control signal providing: (i) a first voltage pulse in a first phase of said signal within a first quarter period of a control cycle, (ii) a second voltage pulse and a third voltage pulse concurrently in a second phase of said signal within a second quarter period of said control cycle, (iii) a fourth voltage pulse of said signal within a third quarter period of said control cycle, and (iv) a fifth and a sixth voltage pulse concurrently in a fourth phase of said signal within a fourth quarter period of said control cycle.

21. The system of claim 18 wherein a mode of no transport is imparted to said biomolecules by said control signal providing: (i) a first voltage pulse and a second voltage pulse concurrently in a first phase of said signal within a first quarter

period of a control cycle, (ii) a third voltage pulse and a fourth voltage pulse concurrently in a second phase of said signal within a second quarter period of said control cycle, (iii) a fifth voltage pulse and a sixth voltage pulse concurrently in a third phase of said signal within a third quarter period of said control cycle, and (iv) a seventh voltage pulse and an eighth voltage pulse concurrently in a fourth phase of said signal within a fourth quarter period of said control cycle.

22. The system of claim 18 wherein each electrode of said plurality of electrodes defines a first end and a second end opposite from said first end, and said voltage controller provides said control signal to both of said first end and said second end of each electrode of said plurality of electrodes.

23. The system of claim 18 wherein said plurality of electrodes includes a plurality of traveling wave modules, said modules arranged in said system in an array having 2 to 20 columns and each said column having 2 to 10 traveling wave modules.

24. The system of claim 18 wherein said plurality of electrodes generally extend in a plane, said system further comprising:

an electrically conductive plane oriented generally parallel with said plane of electrodes.